9. RESOURCE REQUIREMENT

9.1 PHYSICAL RESOURCES

9.1.1 Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

9.1.2 Equipment requirement:

Following Laboratories are required for Diploma Programme in Electronics and Communication Engineering:

1. Measurement Laboratory
2. Electrical Engineering Laboratory
3. Microwave Engineering Laboratory
4. Television Engineering Laboratory
5. Communication System Laboratory - I
6. Communication System Laboratory – II (Advanced)
7. Industrial Electronics Laboratory
8. Control System Laboratory
9. Microprocessor Laboratory 8085, 8086 (Demo Kit)
10. Electronics Devices & Circuits and Network Laboratory
11. Digital Electronics and Digital Circuits Laboratory
12. Analog Integrated Circuits
13. Digital Signal Processing Laboratory
14. Electronics and Instrumentation Laboratory

Note: Some of the laboratories can be clubbed keeping in mind best utilisation of space and equipment, the above mentioned 14 laboratories after clubbing reduce to 10 laboratories which are given below:

EQUIPMENT REQUIRED FOR ELECTRONICS AND COMMUNICATION ENGINEERING

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
1.	**ELECTRONICS LABORATORY**		
1.	DC regulated low voltage variable power supply	10,	25,000
2.	DC regulated multiple output power supply	4	12,000
3.	Audio oscillator	4	16,000
4.	Wide band RC Oscillator	4	10,000
5.	RF Signal Generator	2	8,000
6.	Pulse Generator	2	10,000
7.	Function Generator	4	20,000
8.	Single trace CRO with accessories	4	60,000
9.	Dual trace CRO with accessories	4	1,00,000
10.	Electronic Multimeter DC and AC with different ranges	8	30,000
11.	Electronics digital Multimeter three and a half digit	8	25,000
12.	Digital LCR- Q meter	2	20,000
13.	Transistor tester type 911	1	5,000
14.	Audio output power meter	2	6,000
15.	Mains Voltage stabilizer(3 KVA)	1	10,000
16.	AC Millivoltmeters	4	16,000
17.	DC Millivoltmeters	2	6,000
18.	Voltmeter	5	3,000
19.	DC Ammeter	5	3,000
20.	Battery of different voltage and Ampere hour	2	3,000
21.	Single Phase variac	3	6,000
22.	Rheostat of different wattage and resistance	5	3,000
23.	Servo stabilizer power supply	1	8,000
24.	IC Bread Boards	20	10,000
25.	Distortion factor meter	1	10,000
26.	Decade resistance, capacitance and inductance (four each)	12	12,000
27.	Transducers: Pressure type, thermocouple, LVDT, opto Pick-up, electromagnetic pick-up, ultrasonic pick-up and potentiometer etc	LS	30,000
28.	Thyristor control experimental kits Instrumentation/Transducer experimental kit. Basic electronic experiment kit	LS	2,50,000
29.	Strip chart recorder	1	10,000
30.	Digital Panel meters	6	3,000
31.	Digital thermometer	1	4,000
32.	Stroboscope cum motor drive disc	1	10,000
33.	Digital load indicator with load Cells	1	10,000
34.	Digital Lux meter	1	8,000
35	CROs 20 MHz (Scientific Make)	6 Nos.	22,000
36	Function Generators Audio Frequency	6 Nos.	7,500
37	Regulated Power Supply	6 Nos.	3,600

Sr. No.	Detail of Instrument	Qty.	Per Unit Cost (in Rs)
38	Multimeter (Digital)	10 Nos.	2,000
39	Rectifier Kits	6 Nos.	2,200
40	Filter Circuit Kit	6 Nos.	2,200
41	Bread Boards	12 Nos.	2,800
42	Transistor Kits (a) CB (b) CE	 6 Nos. 6 Nos.	 2,400 2,400
43	FETs	6 Nos.	2,400
44.	Operational Amplifier Kits	6 Nos.	3,000
45.	Raw Materials	LS	20,000

2. COMMUNICATION ENGINEERING LABORATORY(Basic)

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
1.	DC regulated low voltage variable Power Supply	6	12,000
2.	*RF Signal Generator	3	15,000
3.	Electronic Multimeter with different voltage ranges	6	22,000
4.	Electronic Digital Multimeter	6	20,000
5.	Standard Signal Generator	2	50,000
6.	Facsimile(Fax)-transmitter receiver	1	20,000
7.	Radio Receiver Trainer Kits/Deconstruction Models	LS	10,000
8.	AM/FM signal generator	2	20,000
9.	Super heterodyne Receiver radio Demonstration model	1	4,000
10.	Communication receiver	1	5,000
11.	Optical fibre bench	1	25,000
12.			
13.	CRO 25 MHz	3	80,000
14.	Digital frequency meter	1	10,000
15.	50 MHz CRO	1	50,000
16.	Modems, opto coupler different types of microphones and other accessories	LS	10,000
17.	Advanced Communication Trainer	LS	1,00,000
18.	EPFAX, 56 lines including	LS	60,000
19.	Cellular Mobile Kit, Pager etc	2 each	10,000
20.	Pulse Modulation and Demodulation	6	20,000
21.	Pulse Amplitude Modulation and Demodulation	6	18,000
22.	Pulse Width Modulation and Demodulation	6	18,000
23.	Data Formatting and Carrier Modulation Transistor Trainer Model (ST 2106)	6	25,000
24	Carrier Demodulation of Data Reformatting Receiver Trainer Kit (ST 12107)	6	25,000

Sr. No.	Detail of Instrument	Qty.	Per Unit Cost (in Rs)
25.	Audio Input Module Trainer Model (ST 2108)	6	12,000
26.	Audio Output Model Trainer Model (ST 2109)	6	8,000
27.	AM Transmitter Trainer Model (ST 2201) Scientech	6	20,000
28.	AM Receiver Trainer Model (ST 2202) Scientech	6	20,000
29..	FM Communication Trainer Model (ST 2203) Scientech	6	25,000
30.	Sampling Reconstruction Trainer (ST 2101)	6	11,000
31.	Pulse Code Modulation Transmitter (ST 2103)	6	25,000
32.	Pulse Code Modulation Receiver (ST 2104)	6	25,000
33	Delta Adaptive Delta Sigma Modulation and Demodulation Trainer (ST 2105)	6	30,000
3.	**COMMUNICATION SYSTEM LABORATORY – II (Advanced)**		
			Per Unit Cost (in Rs)
1.	Kit - IF Amplifier Transistor	6 Nos.	1,500
2.	Kit – Amplitude Modulation Demodulation (DSB)	6 Nos.	2,500
3.	Kit – Double Balanced Modulator/Demodulator	6 Nos.	4,500
4.	Kit – Frequency Modulator Demodulator (Transistorized)	6 Nos.	2,200
5.	Kit – Computer and locking range of PLL	6 Nos.	1,600
6.	Kit – Frequency Demodulation (IC Based)	6 Nos.	1,600
7.	Kit –Sample and Hold (S/H) function for Digital Study	6 Nos.	2,600
8.	IF Amplifer (IC Based)	6 Nos.	1,600
9.	Frequency Synthesizer	6 Nos.	1,600
4.	**TELEVISION / AUDIO-VIDEO LABORATORY**		
1.	DC regulated low voltage variable power supply	3	10,500
2.	DC regulated low voltage variable power supply	1	6,000
3.	Audio signal generator	4	16,000
4.	RF Oscillator	4	20,000
5.	Electronic multimeter Analog	6	22,000
6.	Electronic digital multimeter	4	12,000
7.	AF output power meter	2	6,000
8.	Signal tracer	2	3,000
9.	Signal Injector	2	500
10.	Colour TV training model	2	80,000
11.	VCR Trainer	1	40,000
12.	UHF/VHF Convertor	3	3,500
13.	CCTV System PAL Based	1 set	40,000
14.	Field Strength meter	1	5,000
15.	Satellite Receiver, Mixer Amplifier	LS	10,000
16.	TV receiving antenna-Yagi,Uda turnstile and log periodic	2	1,000

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
17.	Dish Antenna with LNB	1	10,000
18.	Stereo cassette deck with speakers	1	6,000
19.	RF power meter	1	7,000
20.	Cassette tape recorder Trainer	1	10,000
21.	Compact Disc player system	1	10,000
22.	PA system with microphone	2	5,000
23.	Mixing pre-amplifier	2	5,000
24	Microphone	4	6,000
			Per Unit Cost (in Rs)
25.	TV Trainer Kit (B/W)	6 Nos.	13,000
26.	TV Trainer Kit (Colour)	6 Nos.	33,000
27.	Digital Storage Oscilloscope (Scientific or Hamag)	10 Nos.	34,000
28.	Wobbuloscope (B/W – 250 MHz)	4 Nos.	50,000
29.	Pattern Generators B/W	6 Nos.	3,200
30.	Pattern Generators Colour	6 Nos.	8,000
		Qty.	**Approximate Cost (in Rs)**
31.	Loud Speaker	2	2,000
32.	Cassettee Duplicator	1	2,000
33.	Audio Test System	1	12,000
34.	Digital Frequency Counter	1	5,000
35.	Video Cassette Player	1	15,000
36.	CRO Dual Trace	3	90,000
37.	RF Sweep Generator for TV Alignment	2	25,000
38.	Pattern generator	2	5,000
39.	Video Projector System	1	2,00,000
5.	**ELECTRONICS WORKSHOP**		
1.	Hand Tools Set	5	5,000
2.	Soldering Set`	5,	5,000
3.	Hand Drill	1	3,000
4.	PCB Etching Machine	2	2,500
5.	Silk Screen Printing	2 set	50,000
6.	Drafting Equipment	1 set	15,000
7.	PCB Drilling Machine	1	10,000
8.	Sheet metal folding and binding machine	1	20,000
9.	Sheet metal cutting machine	1	5,000
10.	Centre Lathe	1	15,000
11.	Grinder	1	6,000
12.	Circular saw	1	6,000

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
13.	*DC regulated low voltage variable power supply	2	12,000
14.	*Audio Oscillator	2	6,000
15.	*RF Signal generator	2	8,000
16.	*Digital LCR-Q meter	1	10,000
17.	*Digital multi-meter	4	12,000
18.	*Single trace CRO	2	25,000
19.	*AC Milivoltmeter	1	3,500
20.	IC Bread boards	6	3,000
21.	Soldering stations temperature controlled	7	10,500
22.	Solder suckers with accessories	10	500
6.	**DIGITAL ELECTRONICS AND MICROPROCESSORS LABORATORY**		
1.	*DC regulated low voltage variable power supply	6	15,000
2.	*DC regulated multiple output power supply	3	9,000
3.	Digital IC power supply	8	10,000
4.	*Electronic Digital Multimeter	6	9,000
5.	CRO Dual trace, 25 MHz	4	1,00,000
6.	*Digital frequency meter/universal Counter timer	2	20,000
7.	*Pulse Generator	2	10,000
8.	Logic probes (TTL and CMOS)	2	2,500
9.	Digital logic trainer (TTL)	4	20,000
10.	Logic Trainer Boards	10	10,000
11.	Microprocessor trainer Kits 8085	8	50,000
12.	Microprocessor Trainer Kits 8086	6	60,000
13.	Microprocessor Trainer Kits 8051/8031	5	30,000
14.	Computer Trainer	1	30,000
.			**Rate per Unit**
15.	8085 Micro processor Kit (Vinytics)	15	
16.	9086 Micro processor Kit (Dynalog)	15	2,500
17.	Interfacing Cards	5	2,50,000
18.	Micro-controller Kit 8051 based (Dyna-51)	10	1,00,000
19.	Digital IC Tester Model - Nikki	1 No.	50,000
20.	Universal Programmer	1 No.	7,000
21.	Digital Multimeter (Motwane)	10 No.	60,000
22.	EPROM Programme	1	10,000
23.	EPROM Eraser	1	1,500
24.	Additional cards	LS	50,000
25.	Software	LS	1,50,000
26.	Dotmatrix Printers 24 pin 132 col	2	15,000
27.	Ink jet Printers	2	6,000

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
7.	**MEASUREMENT LABORATORY**		
1.	Light Measurement (Photocells) Kit	8 Nos.	15,000
2.	LVDT Kit	8 Nos.	8,000
3.	Pressure Measurement Kit	8 Nos.	9,500
4.	Strain Measurement Kit	8 Nos.	14,000
5.	Water Level Measurement Kit	8 Nos.	11,500
6.	Velocity Measurement Kit	8 Nos.	7,500
7.	RPM Measurement Kit	8 Nos.	5,000
8.	Temperature Measurement Kit	8 Nos.	5,000
9.	Maxwell's Bridge Kit	8 Nos.	7,500
10.	Wein's Bridge Kit	8 Nos.	4,500
11.	Anderson Bridge Kit	8 Nos.	5,000
12.	Flux Meter (Digital) Kit	8 Nos.	5,000
13.	Q. Meter (Digital) Kit	8 Nos.	5,000
8.	**ELECTRICAL ENGINEERING LABORATORY**		
1.	Ammeter, Voltmeter, Wattmeter and Energy Meters (3- phase and 1- phase)	8 each	40,000
2.	3-Phase Resistive load	4 Nos.	16,000
3.	LCR/Q Bridge	1	5,000
4.	Tong tester	4	12,000
5.	Transformer (single phase)	2	16,000
6.	Watt meter, Volt meter, Ammeter,	2 each	10,000
7.	DC Shunt Motor,2 hp with loading arrangement	1	20,000
8.	Induction Motor (Single phase)	2	10,000
9.	Induction Motor (Three phase)	2	10,000
10.	Slipring Induction Motor 3 HP with loading facility	1	25,000
11.	Alternator and Load for Alternators	1	25,000
12.	DC generator with prime-mover motor	2	25,000
13.	DC Regulated Power Supply	2	6,000
14.	Starters (DOL and Star Delta)	2 each	8,000
15.	Rheostats	4	12,000
16.	Tacho meters (digital)	2	15,000
17.	Maggar (Insulation Tester)	2	5,000
18.	Earth Tester	2	10,000
19.	Digital Multi-meter	10	32,000
20.	Rectifier, Inverter Set	1	10,000

Sr. No.	Detail of Instrument	Qty.	Per Unit Cost (in Rs)
9.	**INDUSTRIAL ELECTRONICS LABORATORY (For Electrical, Electronics and Computer Engineering)**		
1.	Morgan Chopper Kit	6 Nos.	5,000
2.	Joner Chopper	6 Nos.	5,000
3.	Series Inverter	6 Nos.	8,000
4.	Parallel Inverter	6 Nos.	8,000
5.	Speed Control of dc motor (Thyristorized)	6 Nos.	5,000
6.	Single Phase Cyclo Convertor with Thyristors	6 Nos.	20,000
7.	Kit for study of effect of free wheeling diode on power factor	6 Nos.	5,000
8.	SCR Characteristics	6 Nos.	1,500
9.	Gate Triggering Characteristics of SCR	6 Nos.	10,000
10.	AC Phase Control Trainer Kit	6 Nos.	6,000
11.	Kit to Study 3-phase Control Bridge Convertor	6 Nos.	17,500
12.	UJT Characteristics and its Application as Relaxation Oscillator	6 Nos.	1,500
10.	**CONTROL SYSTEM LABORATORY**		
1	Proportional Integral Derivation (PID) Controller Kit	5 Nos.	12,000
2.	DC Motor Position Control System Kit	5 Nos.	18,000
3.	Potentiometer Error detector Kit	5 Nos.	7,500
4.	Stepper Motor with Microprocessor Interface Kit	5 Nos.	17,000
5.	Synchro Transmitter Kit	5 Nos.	15,000
6.	Synchro Control Transformer Kit	5 Nos.	9,000
7.	Speed Torque Characteristics of AC Servomotor Kit	5 Nos.	15,000
8.	Compensating Circuits including lead, lag transient and frequency response of second order system Kit	5 Nos.	15,000

NOTE:

In addition to the above, laboratories in respect of physics, chemistry, applied mechanics, strength of materials, general engineering, workshops, Computer Centre etc will be required for effective implementation of the course. Provision for overhead projectors, TV with VCR facility, slide cum strip projector, photocopiers, PC-XT facilities along with LCD Projection System, drafting machines etc has also to be made.

9.1.3 Furniture Requirement

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

9.2 Human Resources Development:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE

10. RECOMMENDATIONS FOR EFFECTIVE IMPLEMENTATION OF CURRICULUM

The following recommendations are made for effective implementation of this curriculum.

a) While imparting instructions, stress should be laid on the development of practical skills in the students.

b) Field visits be organized as and when required to clarify the concepts, principles and practices involved. For this purpose, time has already been provided in student centred activities

c) Extension lectures from professionals should be organised to impart instructions in specialised areas

d) There is no need of purchasing very costly equipment. Efforts may be made to establish linkages with local industries/field organizations

e) Considerable stress should be laid on personality development of the student, which is very essential for any diploma holder

f) Teachers should generate competitiveness among the students for the development of professional skills.

g) Teachers should take interest in establishing linkages with industries and field organizations for imparting field experiences to their students

h) Hobby clubs and other co-curricular activities be promoted to develop creativity in the students

i) Teachers should be sent for training in the new areas relevant to their field of specialization

j) Students should be given relevant and well thought out project assignments. This will help students in developing creativity and confidence in them for gainful employment (wage and self)

k) A **project bank** should be developed by the **Electronics and Communication Engineering** department of the polytechnic in consultation with other related institutions in the state.

11. LIST OF EXPERTS

The following experts participated/contributed in the revision of curriculum for diploma programme in **Electronics and Communication Engineering** during the workshop for revision of subjects of first year for Haryana state held on 03–04 June, 2003 at National Institute of Technical Teachers' Training and Research, Chandigarh.

From Polytechnics	
1.	Shri Parveen Kadian, Lecturer, Computer Engineering, CR Polytechnic, Rohtak
2.	Shri Haridev Singh, Lecturer, Information Technology, SJP Polytechnic, Damla
3.	Shri Joginder Singh, HOD, Computer Engineering, KCGPW, Ambala City
4.	Shri Sudeep Kumar, Lecturer, Computer Engineering, GPW, Faridabad
5.	Shri KS Jamwal, HOD (Electronics), Govt. Polytechnic, Nilokheri
From NITTTR, Chandigarh	
6.	Shri TN Thukral, Faculty, Curriculum Development Centre **(Coordinator)**

The following experts participated/contributed in the revision of curriculum for diploma programme in **Electronics and Communication Engineering** during the workshops for revision of complete Curriculum for Haryana state held from 29 September – 01 October, 2003 at National Institute of Technical Teachers' Training and Research, Chandigarh.

From Field/Industries/Institutions of Higher Learning	
7.	Shri Arvind Dixit, Chief Executive, Advance Technology, Chandigarh
8.	Shri Ajit Deol, Service Engineer, M/s Advance Technology, 24/1, Phase-11, Industrial Area, Chandigarh
From Polytechnics	
9.	Shri KS Jamwal, HOD (Electronics), Govt. Polytechnic, Nilokheri
10.	Shri Anil Kumar, Lecturer, Electronics, Govt. Polytechnic, Mandi Adampur
11.	Shri Sanjeev Gupta, Sr. Lecturer, Electronics, VTI, Rohatk
12.	Shri Rajiv Sapra, HOD, Electronics, Govt. Polytechnic, Ambala City
13.	Shri Sanjeev Sheoram, Lecturer, Electronics, Govt. Polytechnic, Hisar
14.	Shri VM Kalra, HOD, Electronics and Communication, SJP, Polytechnic, Damla
15.	Shri Sukhbir Singh Kinha, HOD (Officiating), CR Polytechnic, Rohtak
16.	Shri Pankaj Kumar, HOD, Electronics, Govt. Polytechnic, Loharu
From NITTTR, Chandigarh	
17.	Dr. KM Rastogi, Professor and Head, Curriculum Development Centre
18.	Dr. Sanjay Attri, Assistant Professor, Electronics & Communication Dept.
19.	Shri TN Thukral, Faculty, Curriculum Development Centre **(Coordinator)**